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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/815,932	04/02/2004	Kouji Matsuo	04329.2222-01	9409
22852	7590	03/22/2006	EXAMINER	
FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER LLP 901 NEW YORK AVENUE, NW WASHINGTON, DC 20001-4413			RAO, SHRINIVAS H	
			ART UNIT	PAPER NUMBER
			2814	

DATE MAILED: 03/22/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No. 10/815,932	Applicant(s) MATSUO ET AL.	
	Examiner Steven H. Rao	Art Unit 2814	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 05 January 2006.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-11 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☐ Claim(s) 1-11 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 28 January 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. 09/492,780.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>9/18/04, 04/02/04, 01/05/06</u> | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Priority***

Acknowledgment is made of papers filed on January 28, 2000 claiming priority from U.S. Serial No. 09/492,780 filed January 28, 2000 which itself claims priority from prior Japanese Patent Applications No. 11-022688, filed January 29, 1999; No. 11-041343, filed February 19, 1999; and No. 11-267207, filed September 21, 1999.

### ***Information Disclosure Statement***

The IDSs filed on April 02, 2004; August 18, 2004 and Jan 05, 2006 have all been considered and a copy of the initialed PTO-1449 enclosed herewith.

### ***Preliminary Amendment***

Applicants' preliminary amendment filed on April 02, 2004 has been entered. Therefore claims 12-20 have been cancelled. Currently claims 1-11 as recited in the preliminary amendment of April 02, 2004 are currently pending in the Application.

### ***Specification***

The specification is objected to for not including now U.S. Patent No. 6,737,716, to reflect the present state of U.S. Serial No. 09/492,780.


### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

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(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-2, 4-6<sup>and 7</sup> are rejected under 35 U.S.C. 102(b) as being anticipated by 

Nakajima et al. ( U.S. Patent No. 5,907,188 herein after Nakajima).

With respect to claim 1 describes a Nakajima describes a method of manufacturing a semiconductor device, ( Nakajima title) comprising: forming a metal compound film directly or indirectly on a semiconductor substrate ( Nakajima semiconductor substrate 1, metal film 3 on 1fig. 1B) ; forming a metal-containing insulating film consisting of a metal oxide film or a metal silicate film by oxidizing said metal compound film ( 4) ; and forming an electrode on said metal-containing insulating film. ( Nakajima figs. 3A to 3E)

With respect to claim 2 Nakajima describes the method of manufacturing a semiconductor device according to claim 1, wherein said metal compound is formed of a compound that does not bring about a reaction with the semiconductor substrate or with an insulating material positioned below the metal compound film to form a compound. ( 3 tungsten does not react with oxide 4 or substrate 1).

With respect to claim 4 Nakajima describes the method of manufacturing a semiconductor device according to claim 1, wherein formation of said metal compound film and formation of said metal-containing insulating film by oxidation of the metal compound film are repeated a plurality of times. ( Nakajima col. 9 lines 62 to col. 10 line 6).

With respect to claim 5 Nakajima describes the method of manufacturing a semiconductor device according to claim 1, wherein an insulating film selected from the group consisting of a silicon oxide film, a silicon nitride film and a silicon oxynitride film is interposed between said semiconductor substrate and said metal compound film. ( Nakajima 4-oxide , 2-nitride).

With respect to claim 6 Nakajima describes the method of manufacturing a semiconductor device according to claim 1, wherein said metal compound film is selected from the group consisting of a metal nitride film, an oxygen-containing metal nitride film, a silicon-containing metal nitride film, a metal nitride film containing both oxygen and silicon, a metal carbide film, an oxygen-containing metal carbide film, a silicon-containing metal carbide film, a metal carbide film containing both oxygen and silicon, a metal carbonitride film, an oxygen-containing metal carbonitride film, a silicon-containing metal carbonitride film, and a metal carbonitride film containing both oxygen and silicon. ( Nakajima col. 15 line 65- WSiN film i.e. metal nitride film )

With respect to claim 7 Nakajima describes the method of manufacturing a semiconductor device according to claim 1, wherein said metal compound film contains at least one metal selected from the group consisting of titanium, zirconium, hafnium, tantalum, niobium, aluminum, yttrium and cerium (Nakajima claim 8).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the

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subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 3 and 8-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakajima as applied to claims 1-2, 4-6 above and further in view of Hu ( U.S. Patent No. 5,962,904, hereinafter Hu).

With respect to claim 3 Nakajima describes the method of manufacturing a semiconductor device according to claim 1.

Nakajima does not specifically describe wherein said metal compound film has a thickness not larger than 5 nm.

However Hu, a patent from the same field of endeavor describes in col. 3 lines 50 to col.4 line 28 wherein said metal compound film has a thickness not larger than 5 nm to form a barrier film having a resistivity sufficiently low to allow the gate to function efficiently.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to include Hu's thickness of the metal compound layer in Nakajima's device. The motivation to make the above combination is to form a barrier film having a resistivity sufficiently low to allow the gate to function efficiently. ( Hu col. Lines 35-40).

With respect to claim 8 Nakajima describes the method of manufacturing a semiconductor device according to claim 1, wherein said metal-containing insulating film consists of a plurality of first insulating regions formed of pairs containing a metal oxide

of a metal element contained in said metal compound film ( Hu layer 14-crystalline) and a second insulating region formed of an amorphous insulating material in a region except the first insulating regions. ( Hu layer 18 amorphous)

With respect to claim 9 Nakajima describes the method of manufacturing a semiconductor device according to claim 8, wherein said metal compound film contains a metal element forming said metal oxide and silicon, said first insulating region contains a crystal of said metal oxide, and said second insulating region contains silicon, oxygen and a metal element forming said metal oxide. ( Hu layer 14 is crystalline and layer 18 is amorphous).

With respect to claim 10 Nakajima describes the method of manufacturing a semiconductor device according to claim 8, wherein said metal compound film contains a first metal element forming said metal oxide and a second metal element differing from said first metal element ( Hu col. 4 lines 5-11), said first insulating region contains a crystal of said metal oxide, and said second insulating region contains oxygen and said second metal element. ( Hu col. 4 lines 5-11).

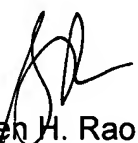
With respect to claim 11 Nakajima describes the method of manufacturing a semiconductor device according to claim 8, wherein said metal compound film contains a metal element forming said metal oxide, said first insulating region is formed of crystal grains of said metal oxide, and said second insulating region is formed of an amorphous region of said metal oxide. ( Hu col. 4 lines 5-11 and layer 14- crystalline and layer 18 – amorphous, Nakajima 3- tungsten, 4-oxide ) .

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steven H. Rao whose telephone number is ( 571)272-1718. The examiner can normally be reached on 8.00 to 5.00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Fahmy Wael can be reached on (571) 272-1714. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

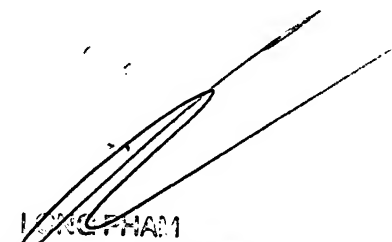
Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Steven H. Rao

Patent Examiner

March 06, 2006.



LONG PHAM  
PRIMARY EXAMINER